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Abstract

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A COMPARISON OF CYCLOPLEGIC REFRACTION WITH DYNAMIC REFRACTION TECHNIQUES IN UNCOVERING LATENT HYPEROPIA

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INTRODUCTION

Although optometrists in most states have the legal option to use diagnostic pharmaceutical agents[1], it is not always in the best interest of either the patient or the optometrist to exercise that option. Even with careful screening techniques to rule out cases with elevated IOP, narrow anterior chamber angles, or hypertension, there are still possible side effects that may occur. Allergic reactions may also occur -- either to the cycloplegic itself or to the anesthetic, when used, which is administered prior to the cycloplegic. Although the occurrence of these side effects is extremely rare, they must be considered whenever a cycloplegic refraction is done.

Besides the possible side effects, there is the consideration of time involvement, both to the doctor and the patient. Once a patient has been administered the cycloplegic, there is a waiting period for the drug to take effect; then there is a longer wait while the action of the drug runs its course. During this time the patient will experience problems associated with the cycloplegia and the accompanying mydriasis, such as blur and increased sensitivity to light. Also, in cases of heavily pigmented irides which do not respond well to cyclopentolate, a stronger cycloplegic may be necessary -- increasing the time involvement as well as the risk of side effects.

Obviously, a non-cycloplegic refraction technique which correlated well with cycloplegic refraction would be beneficial when dealing with cases where additional ciliary tonus was suspected. In other words, if both procedures resulted in the same final prescription lens for the patient, many of the problems of a cycloplegic refraction could be avoided. The process of arriving at that final prescriptive lens may involve adjusting the raw finding

by some constant amount from one set of findings and/or the other to be useful to the patient.

In the past, there have been several different approaches to finding a non-cycloplegic examination method for revealing the refractive error of suspected latent hyperopes, ciliary spasms, etc. It must be kept in mind that these non-cycloplegic procedures will be different from those non-cycloplegic procedures which had as a goal the production of a finding which correlated with the patient's subjective refraction. Mohindra has reported on a dark room technique which presented that type of correlation.[2]

Dorland Smith, in 1926, developed a technique he referred to as "cyclodamia" -- a plus sphere fogging method to produce maximum accommodative relaxation.[3,4] Borish describes the technique and credits Smith's approach as "...the forerunner of many fogging and sudden blurring techniques."[5] There has been some work which has correlated a fogging method of refraction to the use of the cycloplegics atropine and homatropine by O'Brien. He did a study of five hundred patients (1,000 eyes), and found that 75% of the sphere values of both techniques were the same within $\pm$0.50 Diopter. O'Brien felt that the $\pm$0.50 D was probably a measure of the error of repeatability.[6]

Emerson has reported a fogging lens approach that used a +10.00 D lens combined with 20$^{\Delta}$BD prisms as a means of controlling "psychological factors" that lead to discomfort when a patient is fogged.[7]

Humphriss utilized a +0.75 D lens to produce a "psychological septum" similar in concept to the Turville infinity balance method, though different in construct. This is a binocular refraction technique to provide immediate contrast. Foveal vision was suspended while maintaining peripheral fusion.[8]

Viikori has reported that plus fogging technique was effective in decreasing accommodative spasms in a study involving over one hundred patients. His evaluation of a decreased accommodative spasm was based upon whether or not the asthenopic symptoms were eliminated. Using this analysis, he reports 80% of patients either cured or improved.[9]

In 1941, Fry and Reese conducted a study of twelve patients to consider the effects of fogging on accommodation. They devised a new means to measure accommodation and reported that only one of the twelve patients they tested was responsive to increased plus.[10] Flom followed up on Fry's work by postulating that there should be three groups of convergence categories that would correspond to the category found by Fry due to the relationship between accommodation and convergence. In fact, he found four groups -- the three groups that did correspond to Fry's, plus one which was a combination of characteristics from two of those groups. Thus he concludes that the use of fogging lenses to inhibit accommodation or convergence when fixed for distance is questionable.[11]

The senior investigator of this project has used a clinical technique, to be described in this paper, on suspected latent hyperopes and other forms of ciliary spasm dysfunction. The technique appears to result in a final prescription lens of the same power as that which would result from a cycloplegic refraction. That is, the lens that would result from cutting the plus by some amount from the full cycloplegic finding.

We want to know if this procedure does compare significantly to the finding which would result from a cycloplegic refraction modified by some adjustment factor.

METHOD

The subjects for this project are to meet the following criteria:

1. Ages to be between 20-29
2. Refractive findings suggestive of latent hyperopia
3. Be available for refraction on 2 different occasions
4. Have no contraindications to the use of cycloplegics
   a. AC/C > 1/4 (grade 2 or better)
   b. No known allergies to cycloplegic drugs
5. Acuity potential of 20/20 or better OD, OS, OU

The drug to be used for this project is Tropicamide .5%

The design for this project is to be a repeated measures design. We intend to have each subject tested on two separate occasions. The equivalent sphere of the prescription lens as determined by the cycloplegic refraction will be compared to the equivalent sphere of the prescription lens as determined by the fogging-divergence technique, for each subject. The significance of any difference between these two lens values is to be determined by a t-test. Further significance of the relationship between the two lens values will be determined by calculations of the F factor produced by a single factor analysis of variance, a repeated measures design.[12]

PROCEDURE

A. Non-Cycloplegic Refractive Technique

Our first step in the non-cycloplegic refraction was to acquire an objective estimate of the subject's refractive error. In order to eliminate clinician variability, we accomplished this by use of the Canon Auto-Refractor instead of the #4 retinoscopy finding. We then completed a routine subjective

examination using the following sequence:

1. Best monocular sphere or Red-Green
2. Best cylinder (JCC)
3. Best monocular sphere (#7 monocular)
4. 20/40 Equalization
5. Binocular to 20/20 (#7)
6. Binocular to Best Visual Acuity (#7A)

At this point, a #21 Negative Relative Accommodation test was performed, using a reduced Snellen 20/20 line at 40 centimeters. Plus is increased to the blur-out point and then reduced by .25 D. 8^{Δ}BI is now introduced and the subject is asked if the letters are still single and beginning to clear up. If the response is yes, more plus is added to again blur the letters, and the amount of prism is increased to a total of 16^{Δ}BI. If the subject reports that the target is still single and that the 20/20 letters are once again readable, plus is again added to blur-out of the 20/20 line.

The prisms and near chart are now removed and a single 20/20 line of the distance chart is presented. The subject is instructed to stare through the fogging lenses for 5 minutes, even though the chart appears blurred. After the 5 minute time period, the subject is instructed to indicate when they are first able to identify any of the letters as plus power is slowly reduced. The lens power through which the subject can identify 2 or 3 of the 20/20 letters is recorded as the "first identifiable 20/20" lens (R ID). Plus power is then reduced by another .50 D, the 20/15 line is exposed, and visual acuity is evaluated. This lens power is recorded as the "R 7a" lens.

B. Cycloplegic Refraction

The subject's anterior chamber angles were evaluated by means of a

slit lamp examination. Intraocular pressures were then taken using an AO Non-Contact tonometer. If neither of these tests provided any contraindication to the use of a cycloplegic drug, 2 drops of Tropicamide .5% were administered, OD and OS. After 10 minutes, residual accommodation was checked by the following method:

> +2.50 D is added to the retinoscopy finding (#4). As the subject focuses on the 20/20 reduced Snellen line at 40 cm, the card is slowly moved toward the subject. When the subject reports blur of the letters, the distance is measured, and residual accommodation is determined by means of the following formula: Residual Accommodation + Depth of Focus = Target Vergence - Control Lens. The depth of cycloplegia is adequate if RA + DOF is less than ID.

If it was determined that cycloplegia was not sufficient at this point, another drop of Tropicamide .5% was administered, OD and OS, and after 10 minutes residual accommodation was again checked. In some cases, this procedure was again repeated for a total of 4 drops, OD and OS. When cycloplegia was determined to be maximal under these conditions, the Canon Auto-Refractor was again used for the objective finding. The same subjective sequence as used in the non-cycloplegic examination was then performed. The final refractive value was referred to as "Cyc 7a".

Upon completion of the refraction, the angles and pressures were rechecked.

RESULTS

Fifteen subjects who met our criteria were involved with this project. The raw data which resulted is recorded on Table I which lists the sphere,

cylinder, and the axis for each eye of all the subjects. These values were given for the cycloplegic 7a refraction (Cyc 7a), the non-cycloplegic refractive technique 7a (R 7a). As used here, "7a" refers to the maximum plus for Best Visual Acuity.

The results were compared by the use of the student t-test and the single factor analysis of variance for repeated measures to obtain an F score. The spherical equivalent lens values were used to make the calculations. These values are listed in Table I.

The accommodative amplitude was checked by the method described in the text. Of the 15 subjects tested, eight (8) had less than 1.50 D of residual accommodation remaining, for (4) had between 1.50 and 1.75 D of residual accommodation and the remaining three (3) had greater than 1.75 D.

DISCUSSION

It was believed at the onset of this project that our non-cycloplegic (R 7a) refractive technique would prescribe the same lens value as would be derived from a cycloplegic refraction (Cyc 7a) minus some constant. The data produced by this research showed that there was indeed a statistically significant relationship between the Cyc 7a lens and the R 7a lens. The relationship was not the one we had predicted, however. Our original null hypothesis stated that the cycloplegic refraction minus .50 D (Cyc 7a - .50 D) would equal the R 7a. This relationship was evaluated by t-test for related measures. The resulting t value was found to be 9.01 when the scores for the right eyes of the fifteen subjects were used (df=14). The probability of this score occurring through random factors alone is much less than one chance in a thousand (p=.001). Thus, the null hypothesis must be rejected at the p=.001

level. This would mean that when a half-diopter plus is subtracted from the cycloplegic findings, the resulting value is not the same as the R 7a lens value as it was predicted to be.

The data was re-evaluated and it was determined that the R ID and R 7a values are related to the Cyc 7a, if a constant was removed from the R ID and R 7a values rather than from the Cyc 7a. First to be considered is a R ID compared to the Cyc 7a. If .75 D plus was taken away from R ID (R ID - .75D), the result would produce a value very close to the Cyc 7a. This null hypothesis then would be R ID - .75 = Cyc 7a. The level of significance chosen to test this hypothesis was $p = .05$. For this consideration, the values for both left and right eyes were combined giving a $df = 29$ for the t-test, and a tabled t value equal to 2.095. The F value corresponding to the same level of significance would be 4.20 when $df_1/df_2 = 1/28$. Since the calculated scores are lower than the tabled ones for this level of significance, the null hypothesis is accepted. That is to say, the R ID - .75 lens value does equal the Cyc 7a.

The constant which would adjust the R 7a to make it very close to the cycloplegic refraction was .25 (R 7a - .25). Again, the $n = 30$ eyes, the same as above. The tabled values for t and F are taken for $p = .05$ and would be the same as above. The resulting calculated values for this relationship was: $t = 1.341$ and $F = 1.80$. Since these values are lower, it is concluded that there is no significant difference between these findings, thus accepting this null hypothesis as well at the $p = .05$ level. This means that when the R 7a lens value as determined in this project has .25 D plus removed, it would correspond to the Cyc 7a lens value as determined in this project.

One of the significant drawbacks to this study involves the cycloplegic agent used, .5% Tropicamide. Tropicamide has been shown to be an effective cycloplegic agent. This drug was chosen over others, in that Tropicamide has been shown to be less inhibited in its action when used with dark irides than the more commonly used cyclopenalate.[13] Tropicamide is a fast acting agent which has a latency of 15 to 20 minutes. This latency was not a problem in that the researchers were able to be with the subjects at all times monitoring the residual accommodation. The problem seemed to be that too many of our subjects (46%) had 1.50 D or more residual accommodation. The best explanation for this is seemingly that there was a conservative administration of the drops. In retrospect, four drops should have been administered to each patient for the first application, instead of giving two, then checking later to determine if more was needed.

As stated earlier, Fry and Reese determined that plus fogging lenses did not relax accommodation. The findings of this project seem to be at variance with their opinion. If plus lens did not relax accommodation, the only difference expected between the subjective best visual acuity lens and the R 7a lens would have been only those due to random variation. This would be the case since both findings are limited by the high acuity demand under each conditions that would prevent very much fluctuation beyond normal adjustments. In this project, there was found a significant difference at the $p = .001$ level between the R 7a and the Subjective lens. Fifteen equivalent spheres of the subjective BVA lenses was compared to the equivalent spheres of the R 7a. The resulting F values was 18.15 for the right eye values and 23.72 for the left eye values. If a significant level of $p = .001$ is chosen, this would correspond to $F = 17.14$ when $df = 1/14$. Since the F value for both the left

eye (F = 23.7) and right eye (F = 18.1) both exceed this tabled value, the null hypothesis must be rejected at a very significant level. This suggests that random factors do not account for the observed differences. It would seem that accommodation is what is being varied by the plus lenses.

Another set of findings in this project which suggests that accommodation is inhibited by the plus lenses are those which result in comparing the refractive technique lens values and the cycloplegic lens values with the subjective BVA. Cycloplegic refractions on hyperopes tend to show a more plus lens value than a subjective. This is usually attributed to the ciliary muscle being paralyzed, hence inhibiting a full accommodative response. Generally a hyperope will show about .40 D more plus than the subjective. In this study, the average difference was not this great being .17 D, but the cycloplegic exam still was the more plus. If the R 7a lens average values are now compared to the subjective, in this project a difference of .40 D is found with the more plus lens being the R 7a. Since more plus is associated with the cycloplegic exam and it is believed to inhibit accommodation, it is inferred that the plus shown by the refractive technique must also be linked to inhibition of accommodation. These findings, however, are beyond the thrust of this research project.

SUMMARY

This project began with the premise that the Cyc 71 - .50 D would equal the R 7a. As it turned out, a relationship did exist between the Cyc 7a and the R 7a, but the relationship was the R 7a was the more plus value and an approximation of the cycloplegic refraction would result if a constant of .25 D was removed from the R 7a lens finding. This relationship

was found to be significant at the p=.05 level. A concern for this project exists, in that there was evidence that full cycloplegia was not obtained and further testing to see if this was in fact a complicating factor is indicated. Some thought concerning the theory of plus effects on accommodation were expressed. There was evidence presented which suggested that accommodation is inhibited by the plus lenses.

TABLE I

	Subject :	1	2	3
Non-Cycloplegic Refraction	Auto-Refractor	+ .75-.37 X 015 + .50-.87 X 180	- .25-.25 X 050 + .25-.75 X 125	+1.25-.75 X 030 +1.25-.50 X 150
	Red/Green + JCC	+ .50-.37 X 015 Pl -.87 X 180	Pl -.25 X 105 + .25-.50 X 090	+2.50-.25 X 005 +2.50-.50 X 165
	# 7 (bin to 20/20)	+2.00-.37 X 015 +2.00-.87 X 180	+ .75-.25 X 105 +1.00-.50 X 090	+2.25-.25 X 005 +2.25-.50 X 165
	# 7A (bin to BVA)	+ .75-.37 X 015 + .75-.87 X 180	+ .25-.25 X 105 + .50-.50 X 090	+1.50-.25 X 005 +1.50-.50 X 165
	# 7A Eq sph	+ .56 + .31	+ .12 + .25	+1.37 +1.25
Blur/BI Refraction	# 21 Preset	+3.50 +3.50	+3.00 +3.25	+4.50 +4.50
	1st ID of 20/20	+2.00-.37 X 015 +2.00-.87 X 180	+1.00-.25 X 105 +1.00-.50 X 090	+2.50-.25 X 005 +2.50-.50 X 165
	1st ID Eq sph	+1.91 +1.66	+ .87 + .75	+2.37 +2.25
	BVA	+1.50-.37 X 015 +1.50-.87 X 180	+ .75-.25 X 105 + .75-.50 X 090	+2.00-.25 X 005 +2.00-.50 X 165
	BVA Eq sph	+1.31 +1.06	+ .62 + .50	+1.87 +1.75
Cycloplegic Refraction	Auto-Refractor	+ .75-.37 X 018 + .62-.87 X 179	+ .25-.25 X 020 + .50-.50X 135	+2.25-.75 X 031 +2.25-.62 X 162
	Red/Green + JCC	+ .50-.37 X 018 Pl -.87 X 179	+ .50-.25 X 020 + .75-.50 X 135	+2.00-.25 X 025 +2.00-.50 X 180
	# 7 (bin to 20/20)	+1.50-.37 X 018 +1.50-.87 X 179	+ .75-.25 X 020 + .75-.50 X 135	+2.25-.25 X 025 +2.25-.50 X 180
	# 7A (bin to BVA)	+1.00-.37 X 018 +1.00-.87 X 179	+ .25-.25 X 020 + .25-.50 X 135	+1.75-.25 X 025 +1.75-.50 X 180
	# 7A Eq sph	+ .81 + .66	+ .12 Pl	+1.62 +1.50
	Residual Accom	1.25	1.00	1.25

TABLE I (cont)

Subject :	4	5	6	7
Auto-Refractor	+ .50-.25 X 100 + .50-.25 X 105	+ .25-.50 X 105 + .25-.50 X 085	+ .12-.37 X 025 +.62-1.37 X 113	+ .25-.50 X 080 Pl -.25 X 140
Red/Green + JCC	+1.00-.25 X 120 + .75-.25 X 020	+ .25-.50 X 115 + .75-.25 X 067	+ .50-.25 X 180 Pl-.50 X 105	+ .50-.50 X 075 + .25-.25 X 105
# 7	+1.50-.25 X 120 +1.25-.25 X 020	+1.25-.50 X 115 +1.75-.25 X 067	+1.00-.25 X 180 +1.25-.50 X 105	+1.50-.50 X 075 +2.00-.25 X 105
# 7A	+1.00-.25 X 120 +.75 -.25 X 020	+ .25-.50 X 115 + .75-.25 X 067	+ .50-.25 X 180 + .75-.50 X 105	+ .25-.50 X 075 +.50 -.25 X 105
# 7A Eq sph	+ .87 + .62	PL + .62	+ .37 + .50	Pl + .37
# 21 Preset	+4.00 +3.75	+3.75 +4.25	+2.75 +3.00	+2.75 +3.00
1 ID	+1.50-.25 X 120 +1.50-.25 X 020	+1.25-.50 X 115 +1.75-.25 X 067	+1.75-.25 X 180 +2.00-.50 X 105	+1.75-.50 X 075 +2.00-.25 X 105
1 ID Eq sph	+1.37 +1.37	+1.00 +1.62	+1.62 +1.75	+1.50 +1.87
BVA	+1.00-.25 X 120 +1.00-.25 X 020	+ .50-.50 X 115 +1.00-.25 X 067	+1.00-.25 X 180 +1.25-.50 X 105	+ .75-.50 X 075 +1.00-.25 X 105
BVA Eq sph	+ .87 + .87	+ .25 + .87	+ .87 +1.00	+ .50 + .87
Auto-Refractor	+ .62-.25 X 100 + .75 DS	+ .50-.25 X 107 + .87-.37 X 085	+ .62-.37 X 008 +1.25-.62 X 115	+ .75-.62 X 080 + .62-.25 X 104
Red/Green + JCC	+1.00-.25 X 130 +1.00-.25 X 020	+ .25 DS + .75 DS	+ .75-.25 X 008 + .75-.25 X 115	
# 7	+1.25-.25 X 130 +1.25-.25 X 020	+1.00 DS +1.50 DS	+1.25-.25 X 005 +1.25-.25 X 115	+1.50-.25 X 060 +1.25 DS
# 7A	+1.00-.25 X 130 +1.00-.25 X 020	+ .50 DS +1.00 DS	+ .50-.25 X 008 + .50-.25 X 115	+ .75-.25 X 060 + .50 DS
# 7A Eq sph	+ .87 + .87	+ .50 +1.00	+ .37 + .37	+ .62 + .50
Residual Accom	0.75	1.75	1.25	1.75

TABLE I (cont)

Subject :	8	9	10	11
Auto-Refractor	+.50-1.00 X 007 +.25 -.87 X 170		+ .75-.50 X 095 + .75-.50 X 105	- .50-.25 X 100 Pl -.50 X 005
Red/Green + JCC	+ .75-.50 X 160 + .75-.50 X 012		+ .75-.25 X 100 + .75-.25 X 105	- .25 DS Pl-.25 X 015
# 7	+1.00-.50 X 160 +1.00-.50 X 012	+1.50-.50 X 090 +2.00-.75 X 080	+1.75-.25 X 100 +2.00-.25 X 105	+1.00 DS +1.00-.25 X 015
# 7A	Pl -.50 X 160 Pl -.50 X 012	+1.00-.50 X 090 +1.50-.75 X 080	+1.00-.25 X 100 +1.25-.25 X 105	+ .25 DS + .25-.25 X 015
# 7A Eq sph	- .25 -.25	+ .75 +1.12	+ .87 +1.12	+ .25 + .12
# 21 Preset	+1.25 +1.00	+3.25 +3.25	+4.50 +4.75	+4.75 +4.75
1 ID	+1.50-.50 X 160 +1.25-.50 X 012	+2.00-.50 X 090 +2.00-.75 X 080	+1.75-.25 X 100 +2.00-.25 X 105	+1.50 DS +1.50-.25 X 015
1 ID Eq sph	+1.25 +1.00	+1.75 +1.62	+1.62 +1.87	+1.50 +1.37
BVA	+1.00-.50 X 160 + .75-.50 X 012	+1.50-.50 X 090 +1.50-.75 X 080	+ .75-.25 X 100 +1.00-.25 X 105	+ .75 DS + .75-.25 X 015
BVA Eq sph	+ .75 + .50	+1.25 +1.12	+ .62 + .87	+ .75 + .62
Auto-Refractor	+1.25-1.00 X180 +1.25-.87 X 175		+ .75-.50 X 105 +1.25-.75 X 095	- .25 DS + .25-.50 X 180
Red/Green + JCC	+1.50-.75 X 170 +1.75-.75 X 015	+1.25-.25 X 090 +1.25-.25 X 090	+1.00-.25 X 105 +1.50-.25 X 100	Pl DS Pl -.25 X 005
# 7	+2.00-.75 X 170 +2.00-.75 X 015	+1.25-.25 X 090 +1.25-.25 X 090	+1.50-.25 X 105 +2.00-.25 X 100	+1.00 DS +1.00-.25 X 005
# 7A	+1.25-.75 X 170 +1.25-.75 X 015	+ .50-.25 X 090 + .50-.25 X 090	+ .75-.25 X 105 +1.25-.25 X 100	+ .50 DS + .50-.25 X 005
# 7A Eq sph	+ .87 + .87	+ .37 + .37	+ .62 +1.12	+ .50 + .37
Residual Accom	1.00		1.50	1.50

TABLE I (cont)

Subject :	12	13	14	15
Auto-Refractor	+ .25 DS + .25-.25 X 060	-.25-1.00 X 100 Pl -.50 X 075	+ .50-.75 X 080 +.75-1.00 X 110	Pl -.25 X 015 Pl -.25 X 015
Red/Green + JCC	+ .25-.25 X 165 + .50-.25 X 050	Pl -.25 X 100 - .25-.50 X 065	+ .50-.25 X 100 +1.00-.50 X 095	+ .25-.50 X 165 Pl -.50 X 015
# 7	+1.25-.25 X 165 +1.25-.25 X 050	+ .75-.25 X 100 + .75-.50 X 065	+2.00-.25 X 100 +2.25-.50 X 095	+1.50-.50 X 165 +1.75-.50 X 015
# 7A	+ .75-.25 X 165 + .75-.25 X 050	Pl -.25 X 100 Pl -.50 X 065	+1.50-.25 X 100 +1.75-.50 X 095	+ .75-.50 X 165 +1.00-.50 X 015
# 7A Eq sph	+ .62 + .62	- .12 - .25	+1.37 +1.50	+ .25 + .75
# 21 Preset	+4.00 +4.00	+4.25 +4.25	+5.00 +5.25	+4.50 +4.75
1 ID	+1.50-.25 X 165 +1.50-.25 X 050	+1.00-.25 X 100 +1.00-.50 X 065	+2.25-.25 X 100 +2.50-.50 X 095	+1.75-.50 X 165 +2.00-.50 X 015
1 ID Eq sph	+1.37 +1.37	+ .87 + .75	+2.12 +2.25	+1.50 +1.75
BVA	+ .75-.25 X 165 + .75-.25 X 050	Pl -.25 X 100 Pl -.50 X 065	+1.50-.25 X 100 +1.75-.50 X 095	+1.25-.50 X 165 +1.50-.50 X 015
BVA Eq sph	+ .62 + .62	- .12 - .25	+1.37 +1.50	+1.00 +1.25
Auto-Refractor	+ .75-.25 X 170 + .75-.25 X 055	Pl-1.00 X 100 + .25-.75 X 080	+1.25-.50 X 074 +1.25-.75 X 110	+ .25-.25 X 010 + .75-.25 X 010
Red/Green + JCC	+ .75-.50 X 170 + .50-.25 X 030	+ .25-.25 X 100 + .25-.50 X 070	+1.50-.25 X 095 +1.75-.50 X 095	+ .50-.50 X 160 + .75-.50 X 025
# 7	+1.50-.50 X 170 +1.25-.25 X 030	+ .75-.25 X 100 + .75-.50 X 070	+2.25-.25 X 095 +2.25-.50 X 095	+1.50-.50 X 160 +1.75-.50 X 025
# 7A	+1.00-.50 X 170 + .75-.25 X 030	Pl -.25 X 100 Pl -.50 X 070	+1.50-.25 X 095 +1.50-.50 X 095	+1.00-.50 X 160 +1.25-.50 X 025
# 7A Eq sph	+ .75 + .62	- .12 - .25	+1.37 +1.25	+ .75 +1.00
Residual Accom	1.25	1.75	1.00	2.00

TABLE II

	t	F	
OD + OS Eq sphere Cyc 7A ⊂ BI(1 ID)-.75	1.719	2.957	$p < .10$
OD + OS Eq sphere Cyc 7A ⊂ BI(1 ID)-.25	1.341	1.800	$p > .2$
OD + OS Eq sphere Cyc 7A-.12 ⊂ Subj 7A	1.086	1.178	$p > .2$
OD Eq sphere Subj 7A ⊂ BI(BVA)	4.261	18.15	
OS Eq sphere Subj 7A ⊂ BI(BVA)	4.871	23.72	

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